Safety aspects in Welding & Cutting

1.0 INTRODUCTION:

Almost all metal welding & cutting operations involve an intense heat source that can harm the operator's eye, skin, etc and can cause potential health & fire hazards. So, sufficient measures are taken to protect the welder for safe practices. Welders can encounter dangers for insufficient measures against-

- Electric shock
- Overexposure to radiation
- Fumes & gases
- Fire or Explosion

Safe practices encompass an assimilation of methodology, habit and attitude of people to work in a more conducive atmosphere taking care of – a) Self, b) Fellow workmen, c) Surroundings and d) Environments.

Awareness must reach to all level of people and suitable measures shall be adopted to follow safety precautions & safe practices in the shop floor. OSHA (Occupational Safety and Health Act of USA) outlines the requirement of safety in the work place. For all materials, machine to consumable MSDS (Material Safety Data Sheet) shall be available. MSDS is a document that identifies material present in products that have hazardous or toxic properties and also mention the safe handling practices about them. In case of presence of any hazardous materials, the Threshold limit value (TLV) – the permissible level of exposure limits shall also be mentioned in the MSDS.

2.0 WELDING ACCESSORIES:

The articles required for welding & cutting should ensure safety and guard to the health of the welder. All these components must have certain minimum quality requirements as per the various national & international standards.

2.1 Electrode holder – Shall be fully insulated against the maximum voltage encountered to ground. Also it should be sufficiently robust to withstand the heat at maximum welding current at maximum duty cycle.

2.2 Cables & connectors – Cables must be completely insulated, flexible and capable of handling the maximum current and must conform to relevant national or international specifications. The cables must be free from repair or splices up to a minimum distance of 3 meter from the electrode holder.

2.3 Head shield & Goggles – Care must be taken to protect the eye and the head at the time of welding and cutting. The shade number of dark glass is also important.

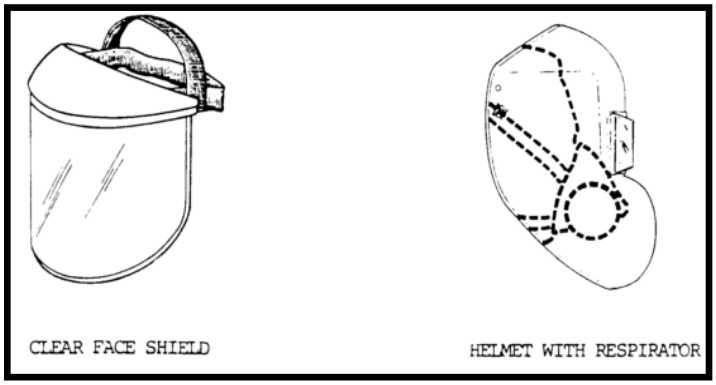


Table-1: Recommended shade number of glasses for various welding & cutting conditions

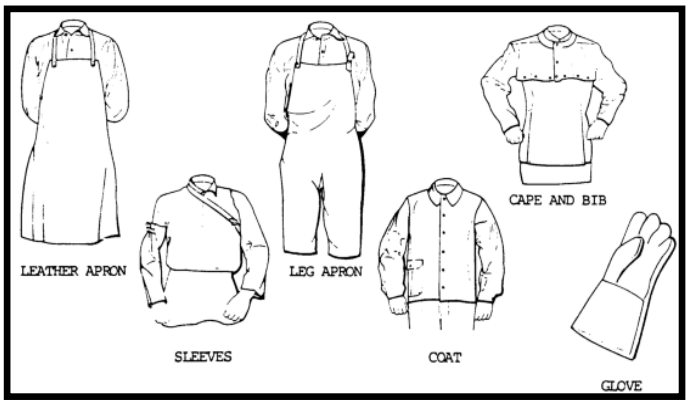
SMAW	GMAW & FCAW	GTAW
Less than 60 amp -------- 7	Less than 60 amp -------- 7	Less than 50 amp -------- 8
60-160 amp ---------- 8	60-160 amp ---------- 10	50-150 amp ---------- 8
160-250 amp ---------- 10	160-250 amp ---------- 10	150-500 amp ---------- 10
250-550 amp ---------- 11	250-500 amp ---------- 10	

Gas Welding	Oxygen Cutting
Light (plate thickness <3.2mm) ---------- 4	Light (plate thickness <25mm) ---------- 3
Medium (plate thickness 3.2-12.7mm) --- 5	Medium (plate thickness 25-150mm) ----- 4
Heavy (plate thickness >12.7mm) -------- 6	Heavy (plate thickness >150mm) --------- 5

2.4 Steel-toed boots – Protect the foot from any falling objects.

2.5 Protective Clothing – According to OSHA regulations, personal protection protective clothing must allow freedom of movement while providing -

- ✓ adequate coverage against burns
- ✓ from sparks,
- ✓ weld spatter, and
- ✓ arc radiation.



2.6 Screen – Protect the workers or passerby from the glare of welding.

2.7 Fume Extractor – Takes the fume out from the vicinity of the welding area and thereby protect the welder from inhaling of undesired smokes. It may be in the form of an exhaust hood or of a kind of wheel mounted suction chamber.

3.0 COMMON WELDING & CUTTING RELATED HAZARDS:

Safety aspects in Welding & Cutting

The common hazards faced during the welding & cutting operations and their likely causes are mentioned in table-2.

Table-2: Common welding & cutting related hazards & their likely causes

❖ Burn Injuries	❑ Hot spatters from the welding. ❑ Touching of hot jobs or holders. ❑ Flash due to electrical short circuit. ❑ Burns due to excessive heat.
❖ Eye Injuries	❑ Seeing the arc welding rays directly or indirectly. ❑ Seeing the gas welding and cutting flame. ❑ Contact with the fume that emanate during welding. ❑ Removal & cleaning of slag and spatter.
❖ Electric Shock	❑ Improper earth connections. ❑ Faulty welding equipment. ❑ Change of SMAW electrode in bare hand. ❑ Insufficient insulation in electrode holders & cables. ❑ Wet gloves/ aprons/ safety boots.
❖ Heat Effects	❑ Excessive heat causes heat exhaustion and heat cramps. The symptoms are hot dry skin, severe headache, visual disturbances, rapid rise of body temperature, tiredness, weak pulse, etc. ❑ Consumption of large quantity of water is helpful. ❑ Asbestos sheet may be used wherever necessary.
❖ Explosion & Fire	❑ Presence of oil, grease, hose/ pipe carrying oxygen. ❑ Presence of flame in the near vicinity of a tank or closed vessel which contains inflammable liquid. ❑ Exposure of Acetylene cylinders to elevated temperatures ❑ Leakage of inflammable gases from the cylinders. ❑ Backfire from the blow pipe during gas welding. ❑ Ignition of cloths and other combustible material by the flame or hot substance. ❑ Loose connection of electrical cables.
❖ Air pollution	❑ The level of fume concentration should be below the threshold limit value of the pollutant. ❑ Sufficient ventilation must be available with exhaust arrangement and forced air circulation.

	❑ Periodical medical check up must be done. ❑ MSDS of the products shall be studied.
❖ Back fire	❑ Nozzle tip touching the metal surface. ❑ Hot metal piece blocking the tip orifice. ❑ The tip is loose. ❑ The tip is overheated. ❑ Incorrect Oxygen & acetylene pressure. ❑ Frequent deposition of Carbon particle on surface of the return valve. ❑ Hoses fastened with wires instead of hose clips.

4.0 COMMON SAFETY RULES IN WELDING & CUTTING:

The actions to be taken at the time of working and around the surroundings are summarized in table-3. The various aspects are explained in brief in the form of Do's & Don'ts.

Table-3: Common welding & cutting related safety rules

❖ The DO's	✓ Wear leather gloves, adequate clothing and safety boot. ✓ Wear a helmet or use a shield in the vicinity of electric arc. ✓ Remove combustible materials from vicinity of gas cutting operations. ✓ Get immediate attention for burn or eye injury. ✓ Wear safety goggles when chipping, grinding, removal of slag, etc. ✓ Keep booth, floor and adjacent area clean. ✓ Know the locations of fire extinguishers. ✓ See the cable connections are tight and does not become hot. ✓ Close the gas & oxygen supply valves immediately after welding/cutting ✓ Securely block the heavy portable equipments mounted on wheels to prevent any accidental movement. ✓ Properly ground the Work terminal, Electrical parts of the machine.

❖ The Don'ts	× Don't look at an electric arc with naked eye. × Don't use defective helmet or cracked shoes. × Don't pick up hot objects without hand gloves.

- Don't leave the electrode holders on the table.
- Don't weld on closed container that held combustible materials without permission from supervisor.
- Don't weld on wet areas without proper care.
- Don't weld on galvanized metal without permission from supervisor.
- Don't change the Polarity switch while welding.
- Don't change parameter setting while the machine is on-load.
- Don't attempt to repair equipment.
- Don't store cylinders in a closed, wet or unventilated space.
- Don't store cylinders near a heat source or in direct sunlight.
- Don't drag a cylinder, keep them in upright position.

5.0 FEW COMMON SAFETY TAGS & ICONS IN WELDING & CUTTING: